Pest Control

IN COMMERCIAL FRUIT PLANTINGS

By Dwight Powell
S. C. Chandler
Frank W. Owen

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UNIVERSITY OF ILLINOIS COLLEGE OF AGRICULTURE
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Contents

IMPORTANT!

This circular will not be revised until 1959. So please keep your copy over the two-year period.

To keep up-to-date . . .

Tune in on W-I-L-L, the University of Illinois radio station (580 on your dial) each Monday noon. The Illinois Farm Hour will give the latest information on controlling orchard pests. Many other stations have similar programs. Consult your local station, your farm adviser, or the Illinois Agricultural Experiment Station, Urbana, for details.

The Spray Service Report, a weekly release giving the same information as the radio programs, is also available to Illinois orchardists. If you want to receive it each week, send $1.50 to the Illinois Agricultural Extension Service, Mumford Hall, Urbana, to cover first-class mailing. (Either stamps or checks payable to the University of Illinois are acceptable.)

These reports are prepared by the agricultural experiment stations of Indiana, Kentucky, and Illinois, the Kentucky State Horticultural Society, the Federal Deciduous Fruit Insect Laboratory at Vincennes, Indiana, and the Illinois State Natural History Survey.

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PEST CONTROL

In Commercial Fruit Plantings[1]

THE BATTLE against insects, diseases, and other pests in Illinois orchards must be fought each year. In some orchards it has to be carried on in every season. To help in the fight, various experimental agencies are constantly working out better methods of pest control. This circular brings together the latest recommendations from the Illinois, Kentucky, and Indiana Experiment Stations, the Illinois Natural History Survey, and the U. S. Department of Agriculture. You may need to adjust these recommendations to suit your own conditions — *but don't experiment with untested materials and methods.* To do so may mean disaster.

Pest-control practices are so closely linked with other operations that they cannot be easily separated. This circular therefore has attempted to give recommendations necessary for quality fruit — not just adequate pest control. For efficient operation, orchard practices must be well organized. So you are urged to study the following pages carefully in order to cope better with the many problems that face you as a specialist in agriculture.

SOME BASIC STEPS IN PEST CONTROL

Continue Sanitation Practices

With the general use of organic insecticides and fungicides and with the increased cost of hand labor, many growers are omitting sanitation practices. This, however, is definitely a mistake. It is practically impossible to secure a high-quality crop when one depends entirely upon chemical treatments. So if at all possible, the following practices should be observed.

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[1] By DWIGHT POWELL, Professor of Plant Pathology, University of Illinois; S. C. CHANDLER, Associate Entomologist, Illinois State Natural History Survey; and FRANK W. OWEN, Extension Specialist in Fruit Crops. For helpful criticisms and suggestions the authors are indebted to G. C. Decker, Illinois State Natural History Survey; and to Victor W. Kelley, Department of Horticulture.

For codling moth control

1. Remove all rough and loose bark from crotches, trunks, and branches during late winter or spring. Either scrape by hand or use water pressure. Directing a straight stream of water at 500 pounds pressure against the rough bark will clean a mature apple tree in at least 3 minutes.

2. Apply treated bands normally from June 10 to June 30. This will reduce the summer codling moth broods about 50 percent.

3. If possible remove all wormy fruit and destroy. Examine the top third of the tree closely at the end of the first brood.

4. Avoid mulching material coarse enough for a larva to spin a cocoon.

5. Store orchard crates and used baskets in a closed building or at least 5 miles from the orchard. Screen the packing shed if it is near the orchard. These measures keep the adult moths from returning to the orchard the next season.

6. Collect and burn all prunings and other debris. Destroy broken crates and baskets, discarded sacks, weed stems, corn stalks, etc.

7. Store props in a closed building or chemically treat them before the next season.

For disease control

1. Collect and remove infected fruit.

2. Prune out fireblight infections as they appear, cutting 4 to 6 inches below the last point of visible infection.

3. Remove all dropped fruit from the orchard at regular intervals.

4. Remove all pruned wood from the orchard and burn. Do not chop up and leave under the trees.

(For bramble sanitation see page 35; for strawberry sanitation, page 37.)

Pruning Is Very Important

Good pruning is of the greatest importance in good orcharding. A definite annual pruning program will make healthy trees.

For one thing, good pruning is an aid in sanitation. Twigs that have been killed by blight or breakage should be removed to help control Botryosphaeria, frog-eye leaf spot, and black rot. Also, fireblight infections may be reduced by pruning blighted twigs and cankers. Lateral branches should be cut back so that long tips do not extend beyond the periphery of the tree. Such tips are hard to spray and easily become infected with scab. Thus, they may be a source of spores for secondary infection.

Good pruning is a help in spraying as well as in sanitation. If branches are thinned out and the height of tall trees is reduced

(Fig. 1) it is easier to get good coverage of the trees with spray material — and less spray is needed. As already suggested, cutting back lateral branches will also make spraying easier. Such pruning is especially worth while in orchards where spraying is done by the nonstop system. It also appears to be of utmost importance in securing maximum efficiency of concentrate sprays.

Other advantages of good pruning are that it reduces the amount of spray required for thorough coverage of each tree and cuts down fruit-thinning costs.

You can save a lot of pruning time by removing water sprouts with a gloved hand in the early summer. At this period of the year water sprouts can be rubbed off a mature tree in less than a minute. Sprouts up to 12 inches in length can be removed by this method.

Fig. 1. — Tops of high trees should be lowered for convenience in spraying and harvesting. Fruit trees should not be allowed to grow more than about 20 feet high. If trees are already too tall, cut leaders back to horizontal lateral branches (*see arrows*). Too-heavy cutting exposing too much of the top to the sun, may cause branches to sunscald. Light pruning, when the tree first begins to grow too high, is much better.

It Pays to Fertilize

Keeping fruit trees in a good state of vigor is necessary for adequate production and good fruit. Trees not in good vigor may be completely destroyed by what are normally considered minor pests. Vigorous trees, on the other hand, are far less likely to be attacked by insects and disease-producing organisms. If they are injured they will generally recover more rapidly and completely than less thrifty trees.

There are no hard-and-fast rules for fertilizing the orchard. It is, however, important to fertilize annually and to maintain a soil-fertility level high enough to support a vigorous cover crop on the orchard floor.

Many growers apply annually only nitrogen fertilizers, such as ammonium nitrate. Approximate rate is ¼ pound for every year of tree age — too much will harm the finish and color of the fruit. Other growers use complete fertilizers, applying at least 1 or 2 pounds of actual nitrogen a year to mature trees.

Soil tests are useful in deciding how much lime, phosphorus, and potassium to apply. These elements have a definite place in many orchard fertility programs, even though lower amounts are needed for maximum yields of peaches and apples than for maximum production of field crops. Many Illinois orchard soils are highly acid, according to recent studies. This acidity is apparently responsible for toxic concentrations of manganese in the soil, which severely injure some apple and peach trees.

Where orchard soils have pH readings below 5.5, liming should be considered. Soils testing low in phosphorus or potassium should receive enough fertilizer to raise the phosphorus and potassium levels at least to medium.

For information on how to sample your soil and get it tested, write to the Department of Horticulture, University of Illinois, Urbana.

Don't Neglect to Thin Your Fruit[1]

Chemical thinning of fruit trees is becoming increasingly important, since high labor costs make hand thinning almost prohibitive in commercial orchards. However, chemical sprays must be used with caution. Results will vary with variety, tree vigor, time of application, weather conditions, and concentration of material used. The gallonage applied is also of major importance, making it necessary for each grower to work out a program with his own spray equipment. The following suggestions are made for the guidance of those who want to use chemicals for thinning.

[1] These suggestions have been prepared by Victor W. Kelley.

Materials for apples

Hormones are more practical than dinitro materials because thinning may be done after bloom, when the set can be determined and there is little danger of further thinning by late frosts.

When heavy set is expected, use *naphthaleneacetic acid* (NAA) hormones as follows:

1. Apply at calyx or 1 week after. Fruit cracking may result on Transparent and Duchess if thinning sprays are made later than 2 or 3 days after calyx.

2. For Golden Delicious, Transparent, Rome, and Wealthy, use a concentration of 20 parts per million (double the strength recommended by the manufacturers for preharvest sprays).

3. For Grimes, Duchess, and York, use 15 parts per million (1½ times the concentration for preharvest sprays).

4. For Jonathan, Delicious, and Winesap, use 10 parts per million (same concentration as for preharvest sprays) about 1 week after calyx.

5. Remember that it is very easy to over-thin trees low in vigor.

Transparent is particularly susceptible to flagging of foliage by NAA. Therefore, *naphthyl acetamide* (Amid-Thin), which flags the foliage much less than NAA, is suggested for trial on this variety. Tests indicate that the amount to use varies in different years. Concentrations of 50 to 60 parts per million near petal fall are suggested.

Materials for peaches

Best results on peaches have been obtained with *naphthaleneacetic acid* formulations. Use them as follows:

1. Apply 2 weeks after shucks are off. Determine this period as accurately as possible. The thinning spray will be less effective if applied a week too soon or a week too late.

2. For Elberta, Halehaven, Hinner Hale, and Gage Elberta, use 30 parts per million (3 times the concentration for preharvest sprays).

3. For Redhaven use 40 parts per million.

4. For Golden Jubilee and Georgia Belle use 20 parts per million.

Peaches can be thinned with *3-chloro-isopropyl-n-phenyl carbamate* (CIPC) any time between full bloom and two weeks after shuck-off. However, this material has slightly damaged the fruit in some years and it is not considered as safe as NAA. CIPC may be especially adapted for early varieties which need to be thinned before the weather is warm, and also for varieties

whose foliage is very susceptible to NAA injury. Redhaven, for example, is so easily injured by NAA that it probably should not be thinned with this material.

Concentrations of CIPC and times of application suggested for Redhaven are: shortly after full bloom, 150 parts per million; shuck-off, 200 parts per million; one week after shuck-off, 200 parts per million; two weeks after shuck-off, 300 parts per million. These same concentrations are suggested for Elberta, Halehaven, Hinner Hale, and Gage Elberta.

The caustic *dinitro* materials will thin peaches if applied when about 90 percent of the flowers are open. Timing is very important, but correct timing is difficult if weather conditions delay blooming. Dn-Dry thinned Elberta satisfactorily in 1956 when applied at a concentration of 1½ pounds per 100 gallons of water. In earlier tests Elgetol gave good results with Elberta at 1½ to 2 pints in 100 gallons.

General recommendations

Weather conditions must be right. Temperature and humidity are very important in chemical thinning. Drying conditions must be good. If the relative humidity is high so that the spray dries slowly, too-great thinning will result.

Experience in Illinois indicates that when NAA is used, the mean temperature on the day of application should be 60° F. or higher. Similar temperature for a day or two after spraying may also be necessary for good results.

Method of application. Application should be thorough. Spray the trees from both sides, using enough gallonage that the trees will drip. However, do not overspray the lower third of the tree, particularly the inside, which is less vigorous than the upper part.

Apply thinning chemicals as separate sprays. This will permit you to vary the amount of material according to tree vigor and amount of bloom. Also, insecticides and fungicides may alter the power of the thinning spray.

Thinning materials may be applied in dust form. Wet dusts have greater thinning power than dry dusts, probably because more of the material adheres.

BE CAREFUL WITH PESTICIDES

Most Pesticides Are Poisonous

Some pesticides are hazardous to the operator who prepares and applies them; some are toxic to plants; some may leave toxic residues that are dangerous to consumers; and a few are hazardous because they tend to contaminate the flavor of foods or feeds. So be sure to observe strict precautions when using pesticides.

To know what the hazards of a specific pesticide are, *read the labels*. All pesticides sold in interstate commerce have been registered and labeled under federal regulations. The labels contain the most accurate information currently available on the specific uses and the hazards of these materials.

Much of the research that federal agencies are at present doing on pesticides is with the purpose of establishing tolerances for residues in or on food. By now tolerances have been proposed for a number of pesticides (page 10). As new data become available, some of these may be changed — also tolerances on other pesticides will probably be proposed.

The spray schedules in this circular have been planned so that residues at harvest will not exceed these tolerances. Also, as already mentioned, the labels contain accurate and important information. It is especially important to follow the instructions concerning lapse of time between final spray application and harvest.

Remember — do not use more pesticide than needed and do not apply at times when dangerous residues may result.

Careless Use of Pesticides Invites Death

The organic phosphates — including such materials as parathion, malathion, demeton, and TEPP — are especially dangerous chemicals. Careless use of parathion alone has caused one known death and several near deaths in Illinois during the past four years. It is not any safer to use the organic phosphates alternately than it is to use one of them continuously. So, although they are highly effective insecticides they should not be used where a safer material will give reasonably satisfactory

RESIDUES OF DIFFERENT PESTICIDES TOLERATED ON FRUIT

The following list of residue tolerances applies only to the deciduous fruits and strawberries grown in Illinois. If changes are made in this list, a supplement will be issued before the growing season starts. **Growers are urged to follow the manufacturer's label at all times.**

Material	*Tolerance*[a] *(parts per million)*	*Number of days between last application and harvest*
Aramite	1	14
BHC	5	60
Bordeaux mixture	exempt	
Captan	20	1
Chlordane	0.3	40 (60 on peach)
Copper, fixed	exempt	
DDT	7	40 (30 on apple)
DN 111	1	?
2, 4-D	5	7
Demeton (Systox)	0.75	21
Dichlone	0	?
Dieldrin	0.1	40
Dimite	see label	
EPN	3	21
Ferbam	7	?
Glyodin	5	?
Lead arsenate	7 lead	30
Lindane	10	60
Malathion	8	7
Mercury, Organic	0	Not later than 1st cover on apples
Methoxychlor	14	7
Naphthaleneacetic acid	1	7
Nicotine	2	?
Ovex	see label	
Parathion	1	14
Ryania	exempt	
Sulfur	exempt	
Sulphenone	8	14
TDE	7	21
TEPP	0	1
Toxaphene	7	?
Vancide (Niacide)	see label	
Zineb	7	0
Ziram	7	?

[a] "Exempt" means that residues left from spraying are not considered toxic.

control. Where situations demand the application of organic phosphates and where you can enforce proper precautions, their use may be justified.

It is absolutely essential that these precautions be followed:

1. **Do not use with oil,** as oil increases the absorption of organic phosphate by the skin.

2. **Do not spray from the inside of the tree.**

3. **Secure a special respirator** that has been officially approved for use with the organic phosphates. Make sure you have the right mask. An orchard canister is not suitable for the greenhouse. The following respirators are suggested:

Respirator No. 5561, cartridge No. R-561.
American Optical Company, Southbridge, Massachusetts.

Respirator No. CR-72138, cartridge No. CR-49293, filter No. 73488.
Mine Safety Appliances Company, Pittsburgh, Pennsylvania.

Agritox Respirator, cartridge No. 11A, filter No. R-490.
Willson Products, Inc., Reading, Pennsylvania.

4. **Use the mask to protect lips, nose, and mouth** from accumulating residue, especially while you are emptying sacks of organic phosphate into the spray tanks. Wear the mask all the time while spraying in the orchard.

5. **Never spray when you are alone.** You may become suddenly ill and need help to get to the doctor.

6. **Stand out of the drift** when putting the powder into the tank or emptying the sacks of dust into the hopper for dusting — even when you are wearing the proper mask.

7. **Do not wash the material through the screen** into the tank. Sift it in quickly with the screen removed.

8. **Do not breathe dust or powder.**

9. **Dust with the wind** and be careful of the turns at the ends of the rows. A duster or sprayer operated by one man with controls at the tractor is safer than the more common, manually operated, two-man outfit.

10. **Wash hands thoroughly** after each contact with the material and before touching the lips, eyes, etc., and before eating any food.

11. **Do not smoke** while spraying or dusting.

12. **Change clothes and bathe** at least daily. Accidentally soaked clothes should be replaced at once.

Atropine is the emergency antidote for organic-phosphate poisoning. Keep on hand a supply of atropine tablets (1/120 grain or 0.5 mg.). You will need a doctor's prescription to get them. Never take atropine or similar drugs until AFTER warning symptoms appear. Symptoms of organic-phosphate poisoning include headache, blurred vision, weakness, nausea, cramps, diarrhea, and discomfort in the chest. If you feel any symptoms

while spraying with an organic phosphate, quit spraying, take two atropine tablets at once, and go to a doctor.

If you cannot rigidly follow ALL precautions, do not use these materials.

Clinical test. If you handle organic phosphate insecticides regularly, you should go to your doctor periodically for blood cholinesterase determinations.

GRASSHOPPERS, CICADAS, AND RODENTS

Grasshopper Control

For several years grasshoppers have been troublesome in many orchards. Damage may occur on the foliage of young, nonbearing trees or on the fruit and foliage of bearing trees. To control this pest, use one of the following materials:

	Amount per acre for —		
	Young hoppers	*Adult hoppers*	*Residual toxicity*
Chlordane	½ lb. actual	1 lb. actual	Excellent
Toxaphene	1½ lb. actual	2 lb. actual	Excellent
Aldrin	2 oz. actual	2 oz. actual	Excellent
Dieldrin	1 oz. actual	2 oz. actual	Excellent

Cicada Control

A spray containing ¼ to ⅓ pint of 30-percent TEPP concentrate in 100 gallons of water is suggested for application in and around blocks where cicada adults are numerous. This is a contact spray, with almost no residual toxicity, so it is necessary to spray usually at night when the cicadas are at rest. Three or four applications may be needed during the period of emergence.

TEPP is an organic phosphate and is very dangerous. Be sure to follow the precautions given on the preceding pages.

Rodent Control

Orchard inspection

Whenever you are working in the orchard, notice mouse activity, locating the areas with the largest populations. When time permits, such as right after harvest, inspect the whole orchard thoroughly.

After baiting, inspect the orchard every two to four weeks to determine the amount of control obtained and to find out where rebaiting will be necessary.

Mechanical and cultural aids

You can protect small trees, and others as well, by enclosing them with hardware cloth cylinders (galvanized wire screen) having three or four wires to the inch. Tar paper or other heavy paper wrapped around the tree also offers protection against mice and rabbits. When there is no snow, you can protect trees by clearing vegetation and debris from the areas around their bases. Use of a tree hoe or culticutter will destroy many mice.

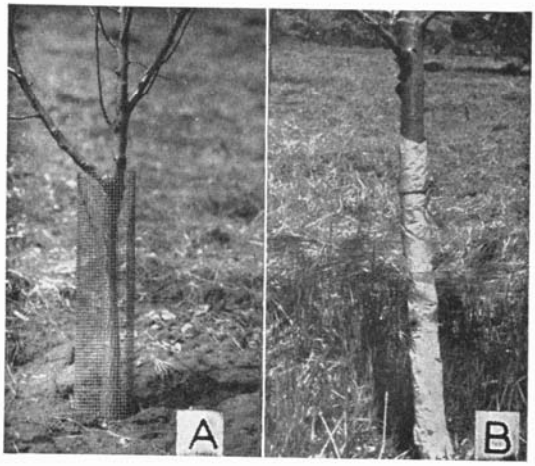


Fig. 2. — **Protection of young trees against damage by rodents and insects is very important.** Failure to do this, even for one season, may result in the complete loss of many trees. Galvanized wire screen, four meshes per inch, placed around the trunk (**A**) gives protection against rodents. Wrapping paper tied around the trunk with twine (**B**) protects against both rodents and wood-boring insects.

Baits — their preparation and use

Treated oats and apples. The most commonly used baits are apple cubes treated with zinc phosphide and strychnine-treated oats. The oats can be bought already treated in 10- and 25-pound bags. Ten pounds of strychnine oats make 900 teaspoonfuls of bait or enough for that many baiting stations.

Apple cubes must be treated with zinc phosphide by the grower. This material can be bought in 1-ounce cans. Follow these directions when preparing the bait:

1. Cut small apples (2 inches in diameter) into sixteen slices or large apples into ½-inch cubes.
2. Measure accurately by quart measure (there are about 100 cubes to a quart).
3. Treat each quart of cubes with 1 level teaspoonful of zinc phosphide. More zinc phosphide will drive the mice away.
4. Prepare bait fresh every day. (One man can expose 5 quarts in half a day.)
5. Do not smoke while preparing bait.

When and where to bait. Late morning and early afternoon are the best times to bait. Mice are most active between two and four in the afternoon.

Place at least four baits in active runways around each tree. Also bait fence rows, drainage ditches around the orchard, and other orchard borders. Areas with large mouse population should be baited first and should receive more than four baits per tree.

Use both apple cubes and oats where both pine mice and meadow mice are active. When using a "trailbuilder," bait with apple cubes on one side of the row and oats on the other side.

Repellents are the most effective way to control rabbit damage on young trees, shrubs, and nursery stock.

For further information about the use of baits and how to obtain them, write to the Extension Specialist on Fruit Crops, Department of Horticulture, University of Illinois, Urbana.

CONTROL OF INSECTS AND DISEASES ON APPLES

Mite Control

Two principal species of mite inhabit Illinois orchards, differing enough in their habits to affect the control measures used. The *European red mite* winters in the egg stage on the tree. The eggs may be found in small cracks and crevices of the growth rings, bud scales, and other rough areas on the twigs. With the

first warm weather, these eggs start to hatch. At this time apple trees may be about at the pink (clusterbud) stage. A dormant oil spray containing 3 percent actual oil, thoroughly applied just before the trees break dormancy in the spring, will destroy these eggs. If this is done, foliar sprays for European red mite may not be needed for the rest of the summer. However, if the dormant spray is not thoroughly applied, enough eggs will escape injury to give an early build-up of this mite. If the dormant is omitted, then one can expect mites to become plentiful by the calyx period.

The *two-spotted mite* winters as an adult under debris on the ground, or under the rough bark of the trees. This species usually starts its summer generations on the ground cover, moving up to the apple trees as the dry mid-summer weather comes. Thus, it is hardly ever noticed on Illinois fruit trees until mid-July. Only summer miticides are effective against this pest.

Unfortunately, while many excellent mite sprays are on the market, some are effective against only one of the two species, while others may be useful against both. Thus, it is important to know your mites and select the right spray for your purpose. A mite spray is not needed until there are at least three mites per leaf. The following sprays are suggested:

Aramite is effective against both species. Use 1½ to 2 pounds in 100 gallons of water. It should be applied in cover sprays during warm weather at approximately 3-week intervals. Interchange with other materials to keep resistance from developing. Aramite is non-toxic to the operator.

Dimite also controls both species, having a residual toxicity of about 3 weeks. Use 1 pint in 100 gallons of water. This material is non-toxic to the operator and presents no residue problem.

Ovex is especially good for controlling European red mites. If no dormant spray has been used, apply ovex at ¼ pound per 100 gallons of water during the pink (clusterbud) and calyx stages. Then in the first cover spray increase the dosage to ½ pound. The latter concentration usually has a residual effect

lasting 4 to 6 weeks. If a dormant spray has been applied, the above applications can be delayed. To reduce high populations immediately, use TEPP wth ovex. Ovex has a very low toxicity to the operator.

Demeton (Systox) is a systemic insecticide and acaricide of special value in controlling mites and aphids. Where a dormant spray has not been applied and European red mites and aphids are prevalent, apply ½ pint of 26-percent demeton per 100 gallons of water in the calyx spray, with a second spray as needed. One spray at this strength will give protection for about 52 days. Demeton is an organic phosphate and is extremely toxic to the operator; so follow the precautions given on pages 9 to 12. Do not apply it within 21 days of harvest.

Other materials. Many growers still successfully use such materials as malathion, parathion, and TEPP for mite control. Some orchards have developed resistant strains of mites, however, and other mite sprays are needed.

Many mite sprays besides those discussed are on the market, but they have not been tested enough to be recommended at this time.

Borer Control

The *roundheaded apple tree borer* usually burrows in the base of the trunk, anywhere from 2 inches below the ground to a foot or more above. Almost perfect control has been achieved with lead arsenate, 3 pounds, and 50-percent DDT, 2 pounds, in 100 gallons of water. Starting 3 weeks after petal fall, make four applications 2 weeks apart. For further information write to the Illinois State Natural History Survey, Urbana.

The *flatheaded apple tree borer* works higher on the trunk and sometimes infests the branches. It nearly always locates on the sunny side of a tree, but may be found on all sides. Weakened trees are especially susceptible. Shading the trunk gives some control. Either wrap it or put two boards, nailed together to form a trough, near the south and west sides. Best protection is to keep trees vigorous.

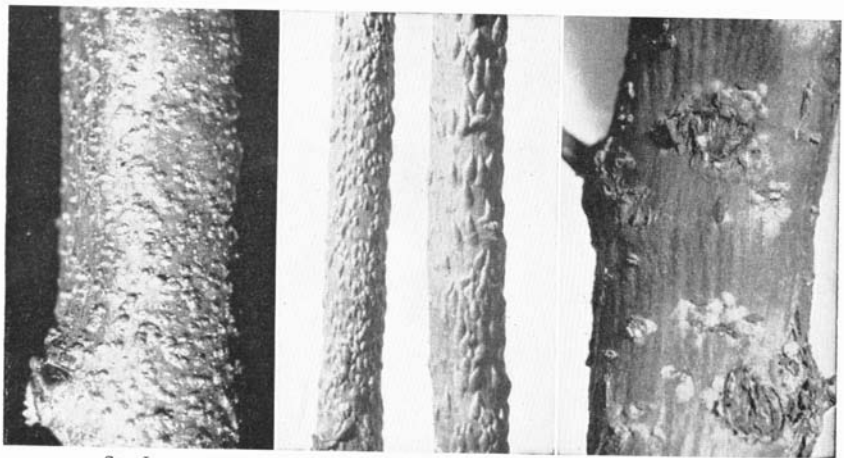


Fig. 3. — **Some important scale insects in Illinois.** San Jose scale is one of the most destructive pests in Illinois apple and peach orchards. Forbes scale has the same general appearance as San Jose scale and is also becoming a major pest on apples and peaches. Oystershell scale is of importance only in the northern half of the state. Scurfy scale causes little damage in well-sprayed orchards.

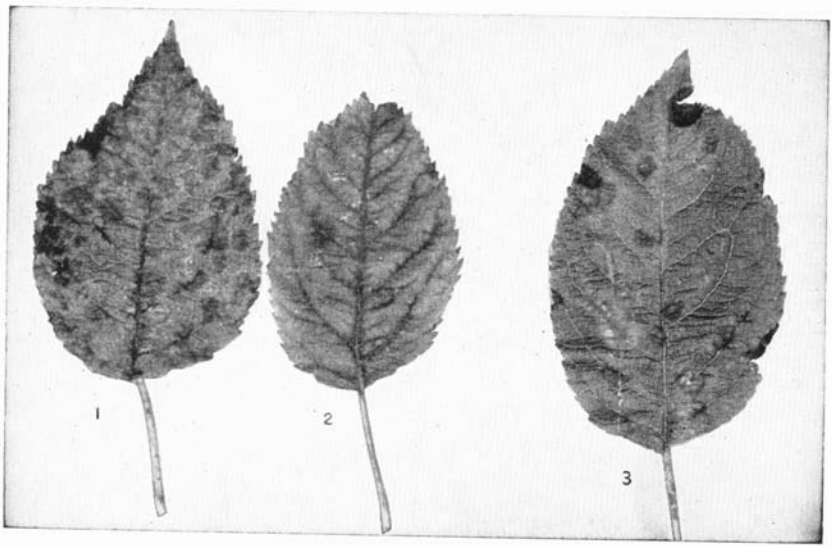


Fig. 4. — **Three types of apple scab on leaves.** (1) Diffused irregular spots. (2) Spots diffused but especially prominent along leaf veins. The most severe spray injury results when caustic sprays are applied to leaves showing this type of scab. (3) Well-defined spots; note also lesions on leaf stem.

Dormant Spray Schedule: All Apples

Purpose	Time to apply	Materials in 100 gallons of water
For all scale insects, aphids, European red mite	Before the buds are open. Early spring is safest and most effective time	Dormant oil, 3 gal. actual; DNC, 1 lb. actual — or — "DN 289," 2 qt.
For only San Jose and Forbes scale, European red mite	.....	Dormant oil, 3 gal. actual
For green and rosy aphid	.....	DNC, 1 lb. actual
For black rot, fireblight, blotch	Late fall is best time	Copper sulfate, 4 lb.

The first recommendation above is designed to destroy all insects and mites which are susceptible to chemicals during the dormant period.

The second suggestion may be followed when aphid control is not essential. This spray will destroy the European red mite eggs and the dormant forms of San Jose and Forbes scale. It will not destroy aphid eggs or the dormant forms of oystershell and scurfy scales.

If you are concerned only with aphid control, then use the third alternative — or some other aphid spray. When only the aphid dormant is applied, keep a close watch for early-season development of scale and red mite.

Copper sulfate applied alone during the strictly dormant period will help to control many diseases. If possible, the material should be applied in the fall, although it may be applied in the spring. Observe carefully that at present this spray should be a special application.

Prepink Spray: All Apples

Purpose	Time to apply	Materials in 100 gallons of water
For apple scab and powdery mildew	Before flower buds show pink (*Fig. 5, Stages 3 through 6*)	Organic mercury, at ½ strength (*see labels for dosages*) plus microfine sulfur, 4 lb. — or — Lime sulfur (liquid, 2 gal., dry, 8 lb.)

Apple scab is still the most serious apple disease. It is important to spray the foliage as soon as the buds break open exposing the new leaves.

Powdery mildew, a new disease to Illinois commercial fruit plantings, appeared in many orchards in 1956. When not controlled, it is very serious on Jonathan and Rome Beauty. Sulfur is recommended for the control of this disease. Microfine sulfur includes the many commercial brands of wettable sulfurs such as the pastes or dry forms having particles with an average diameter of 2 to 10 microns.

Karathane is a new fungicide effective only against powdery mildew and may be used in place of sulfur. (See label for recommendations.) If you use karathane, either increase the mercury to full strength or add another fungicide at one-half strength for scab control.

More than one prepink spray may be necessary when cold and rainy weather prolongs tree development. Sulfur dusts may be used to supplement the sprays.

Pink or Cluster-bud Spray: All Apples

Purpose	Time to apply	Materials in 100 gallons of water
For apple scab and powdery mildew	When most of the buds in the cluster have separated (*Fig. 5, Stages 7 and 8*)	Organic mercury, at ½ strength (*see labels for dosages*) plus microfine sulfur, 4 lb. — or — Microfine sulfur, 8 lb.
If red-banded leaf roller is a problem	.....	50% TDE, 2 lb. added to above spray
For aphids if dormant spray is omitted	.....	15% parathion, 1 lb. added to above spray (*see pages 9 to 12 for precautions*)
If curculio is a problem	.....	50% dieldrin, ½ lb. added to above spray

If all three of the above insect pests need control, parathion can be added to whatever fungicide is used. If only red-banded leaf roller is present TDE should be used because it is more effective than parathion for leaf roller and is less dangerous to handle. If you have been having trouble with curculio, use the dieldrin spray, which also is much safer to use than parathion and which is specifically toxic to curculio.

Normally you will not need dieldrin or TDE in this spray, however, as lead arsenate in the calyx and first-cover sprays will usually control both curculio and red-banded leaf roller. And if you don't absolutely need the chlorinated hydrocarbons (including BHC, chlordane, and DDT, as well as dieldrin and TDE), you shouldn't use them. For when they are applied, the stage is set for an increase in mite population.

If an aphid spray is necessary and if you are reluctant to use parathion, try BHC (during warm weather), malathion, or Black Leaf 40 plus hydrated lime.

Sulfur dusts may be used as supplements to whatever spray is used.

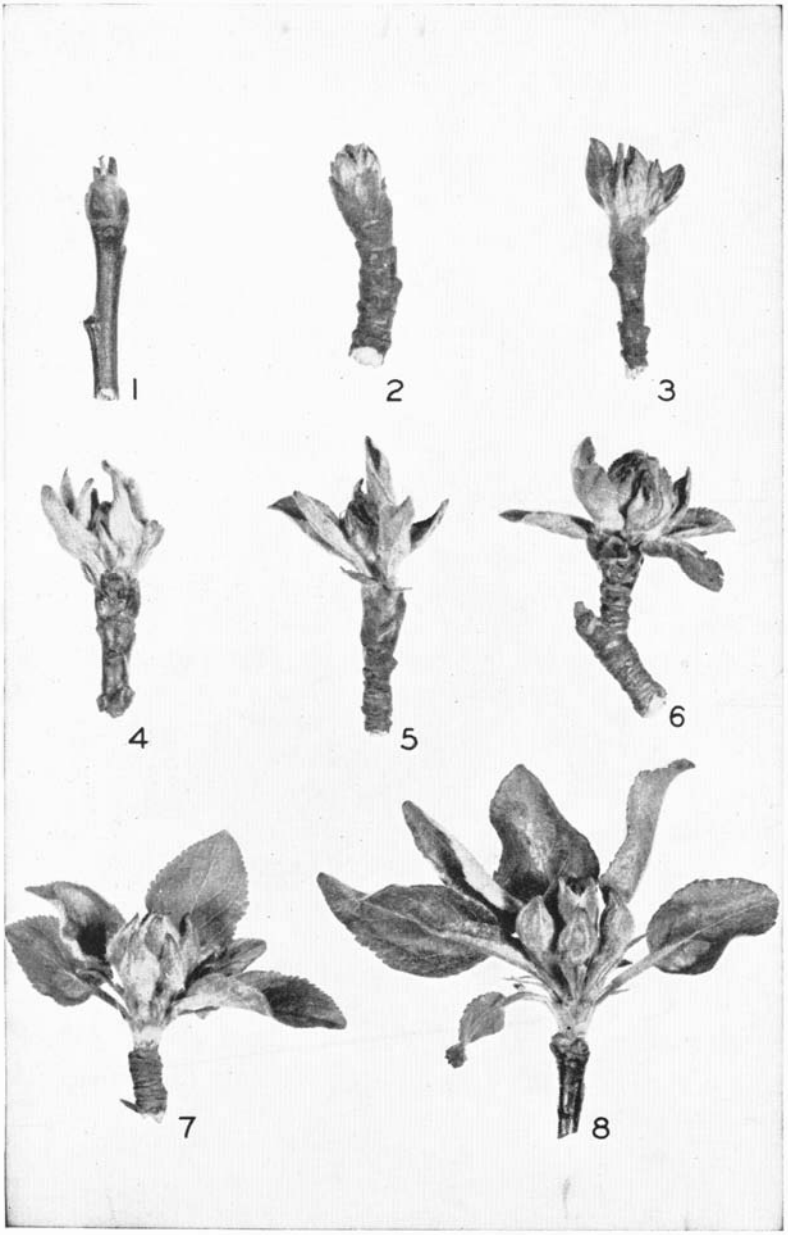


Fig. 5. — Time apple sprays with development of fruit buds. Apply the **strictly dormant** sprays before Stage 1. Apply **delayed dormant** sprays during Stage 2. Apply **prepink** spray between Stages 3 and 6. Start the **pink** spray at Stage 7 (not later than 8), and complete by the time the first flowers open.

Bloom Spray: All Apples

Purpose	Time to apply	Materials in 100 gallons of water
(DO NOT USE LEAD ARSENATE OR OTHER POISONS IN THIS SPRAY)		
For apple scab, cedar and quince rust	When 10% of blossoms have opened	Microfine sulfur, 3 lb. plus either 75% ferbam, 1 lb., or 75% zineb, 1 lb. — or — 75% ferbam, 2 lb. — or — 75% zineb, 2 lb.
For fireblight	2 sprays 4 days apart starting when 10% of blossoms have opened	Copper sulfate, ½ lb. Hydrated lime, 1 lb. Commercial wetting agent, 2-3 oz. — or —
	3 sprays 7 days apart starting when 10% of blossoms have opened	Streptomycin, 50 ppm (*see below*)

In most seasons the cedar galls start discharging spores at the same time that apple trees are beginning to bloom. If problem blocks are not sprayed at this time, they usually give trouble later. For, while either ferbam or zineb applied as a bloom spray is especially effective in controlling the rust diseases, neither can be relied upon to stop an infection after it has once got a good start. If rust is not a problem and cool weather prolongs the blooming period, sulfur with or without ferbam or zineb, or the organic mercuries may be used for scab control.

Fireblight control is still a big problem. Although the Bordeaux spray suggested in the table will reduce blight infection, it will not always give adequate control. Also, Bordeaux applied at this time may result in fruit russet.

Formulations of **streptomycin** have reduced fireblight better than any other material. The degree of control is directly proportional to the number of streptomycin sprays applied. At least three applications, 7 days apart, should be made, starting with the first appearance of the blossoms. This will protect blossoms and twigs for about 21 days. Unfortunately fireblight may infect twigs until mid-July, or for another 55 days. The cost of using streptomycin every 7 days through this entire period would be prohibitive. Thus, the number of sprays used must depend upon the severity of the problem and the grower's pocketbook.

Calyx and First Cover Sprays: Fall and Winter Apples

Purpose	Time to apply	Materials in 100 gallons of water
For codling moth, apple scab, curculio, red-banded leaf roller, cedar and quince rust	**Calyx,** when ¾ of petals have fallen (*see Figs. 6 and 7*) **1st cover,** 7 to 10 days after the calyx spray	Lead arsenate, 3 lb., plus either 75% ferbam, 2 lb., 75% zineb, 2 lb., 50% captan, 2 lb., glyodin, 1 qt., or organic mercury (*see manufacturer's directions*)
If powdery mildew is a problem (Jonathan and Rome Beauty)	.....	Microfine sulfur, 3 lb., added to above, with organic fungicide reduced to half strength
If red-banded leaf roller is a problem	.....	50% TDE, 2 lb. added to above
If curculio is a problem	.....	50% dieldrin, ½ lb. added to above
For fireblight (for growers trying antibiotics)	.....	Streptomycin, 50 ppm, added to above (*see manufacturer's directions*)

If desired, any two of the organic fungicides (captan, glyodin, ferbam, zineb, or mercury) may be combined at half the strength recommended above. Captan and zineb are preferred for Golden Delicious, starting with the calyx spray. A fungicide known as Vancide M (Niacide M) has shown promise in trial tests. It has given excellent finish to Golden Delicious.

Sulfur at half strength is recommended where powdery mildew is a problem.

Lead arsenate should control the red-banded leaf roller satisfactorily unless damage was serious the previous year, indicating a high carry-over of this insect. In that case TDE should be used. The addition of ½ pound of 50-percent dieldrin to the spray is suggested where curculio has been a problem.

If you're using streptomycin for fireblight control, you should complete the third application at about the first cover period.

When time permits, special top-off sprays are suggested after the calyx and first cover sprays. Use the same materials and apply to the top third of the tree within 2 or 3 days after the regular spray. With a top-off spray following the calyx application, the first cover should follow 7 days after the top-off spray.

Fig. 6. (above). — Time to apply calyx spray for scab and codling moth. Petals have just fallen but calyx lobes are still open.

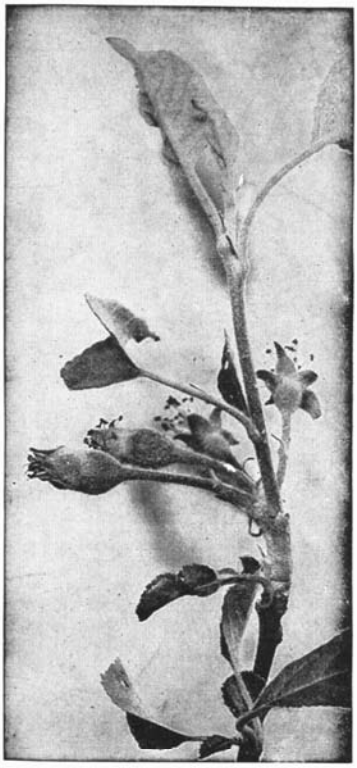


Fig. 7 (right). — Too late for calyx spray. Calyx lobes have closed.

A simple way to figure amount of non-concentrate spray for apple trees: For dormant and *prepink* sprays, divide age of tree by 4 to find gallons needed per tree. For *pink* spray, divide by 3; for *calyx*, divide by 2; for *succeeding* sprays, divide by 1.5. *Example:* a 10-year-old tree should be given the following amounts:

Dormant and prepink stages	2.5 gallons
Pink stage	3.3 gallons
Calyx stage	5.0 gallons
Each succeeding spray	6.7 gallons

Second and Third Cover Sprays: Fall and Winter Apples

Purpose	Time to apply	Materials in 100 gallons of water
For curculio, codling moth, red-banded leaf roller, leaf hopper, scab and blotch	**2d cover,** approximately 7 days after 1st cover (*see spray service report*) **3d cover,** 10 days after 2d cover	Lead arsenate, 2 lb. 50% DDT, 2 lb. — or — 50% DDT, 1½ lb. 25% malathion, 1 lb. — plus either — 50% captan, 1 lb. — or — Glyodin, 1 qt. — or — 75% zineb, 1 lb. — or — Vancide M (Niacide M), 1 lb.

The second cover is one of the most important sprays for codling moth control. At this time of year the first egg hatch occurs and the young larvae attack the fruit. It is important to cover the apples thoroughly before egg hatch starts.

In general, malathion will destroy the same pests as parathion, but it is usually less effective. While it doesn't control codling moths as well as parathion, it is more effective than DDT. It is less dangerous to use than parathion. Nevertheless, you should follow the precautions given for all the organic phosphates (pages 9 to 12).

If desired, any two of the fungicides (captan, glyodin, zineb, or Vancide M) may be combined at one-half the strength recommended above.

Watch for mite development and include a mite spray (pages 14 to 16) in this application if necessary. If leaf rollers continue to be troublesome, add TDE, 1 pound actual in 100 gallons, to the above sprays.

Fourth and Fifth Cover Sprays: Fall and Winter Apples

Purpose	Time to apply	Materials in 100 gallons of water
For codling moth, mites, bitter rot, scale, and apple maggot	**4th cover,** 10 days after 3d cover **5th cover,** 14 days after 4th cover	50% DDT, 2 lb. — or — 50% DDT, 1½ lb. 15% parathion, 1 lb. — or — 50% DDT, 1½ lb. 25% malathion, 2 lb. — plus either — 50% captan, 1 lb. — or — Glyodin, 1 pt. — or — 75% zineb, 1 lb.

After these sprays, thoroughly examine your orchard for codling-moth injury. Look especially in the tree tops; here first-brood codling moths escape chemical control and survive to produce the second brood. Many growers at this time hand-thin and destroy apples that have been injured by codling moth.

From this period on, watch out for excessive residues.

Special sprays. For bitter-rot control use 50-percent captan, 2 pounds in 100 gallons of water in two sprays — the first about 7 days after the fifth cover and the second 10 days later.

Second- and third-brood codling moth sprays should start about 3 weeks after the fifth cover. Make two or three applications, as needed, of the same sprays suggested for the fourth and fifth cover sprays. See the spray service report for more exact timing. Watch for mite development. Red-banded leaf roller may start damage to the fruit at this time. If so use 50% TDE, 2 pounds in 100 gallons of water, but do not apply within 21 days of harvest (page 10).

Spray Schedule: Summer Apples

(Dormant, prepink, pink, and bloom sprays are given on pages 18 to 22.)

Purpose	Time to apply	Materials in 100 gallons of water
For blotch, scab, codling moth, and curculio	**Calyx,** when ¾ of petals have fallen **1st Cover,** 7 days after calyx	Lead arsenate, 3 lb. 50% dieldrin, ½ lb. 75% ferbam, 2 lb.
For codling moth	**2d Cover,** 10 days after 1st cover	50% DDT, 2 lb. — or — 50% DDT, 1½ lb. 15% parathion, 1 lb. — or — 50% DDT, 1½ lb. 25% malathion, 2 lb.
For codling moth	**3d Cover,** 10 days after 2d cover **4th Cover,** 10 days after 3d cover if needed	15% parathion, 2 lb. — or — 25% malathion, 3 lb.

CONCENTRATE SPRAYING has saved time, labor, and materials for a good many orchard men. The theory is to use as much chemical per tree as in the standard schedules, but less water. For example, a standard recommendation for DDT might be 1 pound actual to 100 gallons. With a conventional sprayer, about 600 gallons of this mixture would be needed for an acre of orchard 25 to 30 years old. If the spray were concentrated 3 times, then 3 pounds actual of DDT would be used to 100 gallons of water, and 200 gallons would be used for an acre of orchard. Either way, 6 pounds of DDT would be applied per acre.

Tests have been conducted with as high as 10 to 12 times the normal concentration. Thus far, however, it appears that 2 to 4 times is the most practical concentration for efficient control of orchard insects and diseases.

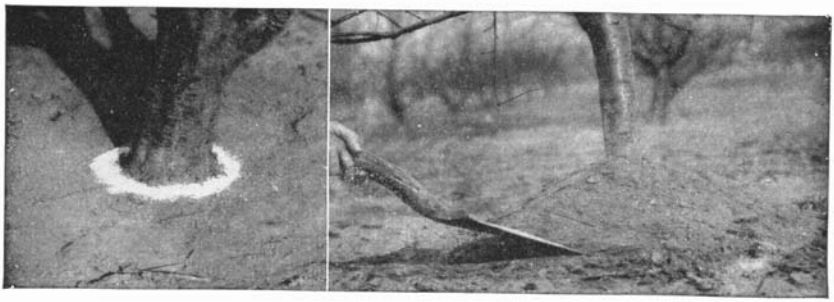


Fig. 8. — **PDB treatment for peach borers** consists of a "death ring" of paradichlorobenzene crystals (*left*) placed close to the trunk of the tree *but not touching the bark*. The ring of crystals is covered with a mound of earth (*right*) to confine the gas. (If you cannot obtain PDB, write to the ILLINOIS NATURAL HISTORY SURVEY, Urbana, Illinois, for directions for using ethylene dichloride.)

PEACHES AND APRICOTS

Borer and Disease Control

The *peach tree borer* attacks plums, cherries, and nectarines, as well as peaches and apricots. It works at the base of the tree and if not controlled annually will kill the tree. Best control method is to apply 50-percent DDT (6 pounds to 100 gallons of water) from the crotch to the base of the trunk. Do not spray the entire tree, or you will have a serious residue problem. Starting about July 8, apply three sprays 3 weeks apart. Use a hand gun rather than a mist blower if the tree has fruit on it.

Crystalline paradichlorobenzene (PDB) will also give reasonably good control. Apply it to the ground in a ring around the tree — just far enough away that it does not touch the bark — then cover it with 3 to 5 spadefuls of earth (Fig. 8). Use these amounts of PDB:

Trees 1 year old, ¼ oz.
Trees 2 years old, ½ oz.
Trees 3 to 5 years old, ¾ oz.
Trees 6 to 10 years old, 1 oz.
Trees older than 10 years, 1 to 2 oz.

Fall treatments are more effective than spring treatments. Soil temperature should be 55° F. or over to volatilize the material. In general, the best dates for treatment are from September 25 to October 15, depending on latitude and soil temperatures.

The *lesser peach tree borer* works higher on the trunk or in crotches and injured places over the tree. It can be controlled

with 15-percent parathion, 3 pounds in 100 gallons of water. Make four applications 3 weeks apart, starting in mid-June. (This treatment may also be used on the peach tree borer.) PDB-oil is reasonably effective against the lesser peach tree borer. Paint affected areas with 2 pounds of PDB crystals dissolved in 1 gallon of miscible oil, and made up to 2 gallons with water.

Bark beetles usually attack only weakened trees or branches, though occasionally they are found on healthy trees. Usually they can be controlled by increasing the vigor of the tree by means of fertilizers, proper drainage, or scale control. Frequently a heavy application of nitrogenous fertilizer corrects the trouble.

The treatments described for the lesser peach tree borer are also moderately effective in controlling bark beetles.

Peach yellows, peach rosette, phony peach, and *yellow-red virosis* are virus diseases of peaches known to be present in Illinois. Peach yellows is often harbored in the plum, where the symptoms are inconspicuous. Wild plums, therefore, should not be left growing near peach orchards. The yellow-red virosis is primarily a disease of chokecherry, but it may spread to peaches. So all chokecherries within half a mile of peach orchards should be destroyed. Common wild black cherry does not carry this virus. If virus diseases are suspected, write the STATE NURSERY INSPECTION SERVICE, Glen Ellyn, Illinois, for an inspection.

Jarring peach and apricot trees is the only good way to get information on the abundance of "catfacing" insects — the plum curculio, tarnished plant bug, and certain of the stink bugs (penatomids) — in the orchard.

A sudden jar of the main framework branches will make the insects fall to a sheet spread beneath the tree. They usually "play possum" long enough to be counted. Make a count on five trees — one in each of the five rows closest to the edge of the orchard (usually the insects are most numerous near the edges). The count indicates the general insect population of the orchard and aids in deciding when to spray and how much insecticide to use. Jar the same trees once a week, keeping a record of the number of insects collected.

Standard Spray Schedule for Peaches and Apricots

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for San Jose and Forbes scale, European red mite, leaf curl	In spring before the buds swell	Dormant oil, 3 gal. actual Copper sulfate, 4 lb. Hydrated lime, 3 lb.
— for scale and mites only	.....	Dormant oil, 3 gal. actual
— for leaf curl only	.....	Any fungicide, full strength
Early bloom, for brown rot, blossom blight, catfacing insects	When 5% of blossoms are open	50% dieldrin, ½ lb. Microfine sulfur, 3 lb. 50% dichlone, ¼ lb.
Full bloom, for blossom blight, catfacing insects, curculio	Full bloom	Microfine sulfur, 3 lb. 50% dichlone, ¼ lb.
Shuck-split, for curculio, brown rot, catfacing insects	When ¼ of shucks are splitting	50% dieldrin, ½ lb. Microfine sulfur, 6 lb.
1st cover, for curculio, scab	10 days after shuck-split	Same as shuck-split
2d cover, for curculio, scab	10 days after 1st cover	Microfine sulfur, 6 lb. — plus either — 15% parathion, 2 lb. *(see pages 9 to 12)* — or — 50% dieldrin, ½ lb.
3d cover, for curculio, oriental fruit moth, scab, and brown rot	10 days after 2d cover	50% captan, 2 lb. — or — Microfine sulfur, 6 lb. — plus either — 15% parathion, 2 lb. — or — 50% dieldrin, ½ lb. 50% DDT, 2 lb.[a]
4th cover, for oriental fruit moth	7 days after 3d cover	15% parathion, 2 lb. — or — 50% DDT, 2 lb. — or — 25% malathion, 3 lb.
5th cover, for curculio, oriental fruit moth, brown rot	1 month before harvest	50% captan, 2 lb. — or — Microfine sulfur, 6 lb. — plus either — 15% parathion, 2 lb. — or — 25% malathion, 3 lb.
6th, 7th, and 8th covers, for brown rot	21, 14, and 7 days before harvest	50% captan, 2 lb.

[a] DDT should not be used at this time on peaches earlier than Elberta, because of the residue problem.

Dust Schedule for Peaches and Apricots

(For dormant applications see standard spray schedule, page 30.)

Application and purpose	Time to apply	Dust formulas
Early bloom, for catfacing insects, blossom blight	When 5% of blossoms are open	Commercial DDT-sulfur dust (preferably containing dichlone) — or — Commercial dieldrin dust (*see footnote a*)
Full bloom, for curculio, catfacing insects, brown rot	Full bloom[b]	Commercial dieldrin dust (*see footnote a*) — or — Commercial parathion dust (*see footnote c*)
Shuck-split, for curculio, catfacing insects, brown rot	When shucks begin to crack	Same as for full bloom
1st cover, for curculio and scab	When shucks are ⅔ off fruit	Same as for full bloom
2d cover, for curculio and scab	7 days after 1st cover	Same as for full bloom
3d cover, for curculio and scab	7 days after 2d cover	Same as for full bloom
4th cover, for curculio	7 days after 3d cover	Same as for full bloom
5th, 6th, and 7th covers, for curculio and oriental fruit moth	At 7-day intervals after 4th cover. (*See spray service report for oriental fruit moth emergence*)	Commercial parathion dust, preferably containing 7.5% captan (*see footnote c*)
8th cover, for curculio, oriental fruit moth, and brown rot	One month before harvest	Same as for 5th, 6th, and 7th covers
9th and 10th covers, for brown rot	At 15 and 7 days before harvest	7.5% captan dust

[a] Commercial dieldrin dust should contain approximately the following ingredients: dieldrin, 2.5 percent; sulfur, 50 percent; oil, 5 precent; inert ingredients, 42.5 percent.

[b] If blooming period is prolonged, make a second application after petal fall.

[c] A 1-percent parathion dust with sulfur has been extremely promising in tests on peaches but is highly dangerous and **should not be used unless all precautions are followed.** Parathion is safest when applied with a liquid duster. **Do not dust when the wind will carry the material into nearby residences.** For other precautions, see pages 9 to 12.

PEARS

Spray Schedule

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for pear psylla and scale	Before buds begin to open. Not needed every year	Dormant oil, 3 gals.
Bloom, for fireblight	2 sprays 4 days apart starting when 10% of blooms are open	Copper sulfate, 1 lb. Hydrated lime, 3 lb. Commercial wetting agent, 2-3 oz. (*for use of streptomycin see page 22*)
Calyx, for codling moth, curculio, leaf spot, and pear scab	As soon as petals have fallen	Lead arsenate, 3 lb. Hydrated lime, 3 lb. Microfine sulfur, 8 lb. — or — Lead arsenate, 3 lb. 75% ferbam, 1½ lb. Soybean flour, ¼ lb.
1st cover, for codling moth, curculio, leaf spot, and pear scab	12 days after calyx spray	Same as for calyx
2d cover, for codling moth, curculio, leaf spot, and scab	14 days after 1st cover	Same as for calyx
3d cover, for codling moth, curculio, leaf spot, and scab	14 days after 2d cover	Same as for calyx
Additional sprays		
—for codling moth and leaf spot.....	Same as for 2d-brood codling moth on apple, if necessary	Same as for 3d cover
—for psylla.....	When nymphs are visible on water sprouts	Copper sulfate, 2 lb. Hydrated lime, 4 lb. Summer oil, 6 qt. — or — 15% parathion, 2 lb. (*see pages 9 to 12 for precautions*)

PLUMS

Plums are subject to two virus diseases, *rosette* and *yellows*. The only way to control these diseases is to remove all infected trees promptly.

Black knot, a fungus disease, may be controlled by removing and burning, for two successive years, all twigs showing knots during the winter months. On large limbs the knots may be cut out, thus saving the limbs. Spraying is sometimes helpful. A delayed dormant spray made of copper sulfate, 12 pounds; hydrated lime, 12 pounds; and miscible dormant oil, 2 gallons for each 100 gallons of water should be applied as buds begin to swell. On infected trees follow this delayed dormant spray with liquid lime sulfur, using 2 gallons in 100 gallons of water for the first and second cover sprays (this will take the place of the recommended copper sulfate-hydrated lime spray).

Spray Schedule for Plums

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale insects	Before buds begin to open	Dormant oil, 3 gal.
1st cover, for curculio	Right after shucks have fallen	Lead arsenate, 3 lb. Copper sulfate, 1 lb. Hydrated lime, 2 lb. Summer oil, 1 qt.
2d cover, for curculio	10 days after 1st cover	Same as for 1st cover
Additional covers		
—for brown rot.....	At weekly intervals starting 3 weeks before harvest	Microfine wettable sulfur, 8 lb.
—for aphids.....	Apply when needed	Soap flakes, 4 lb. Nicotine sulfate (40%), 1 pt.

For borer control see page 28, peach tree borer.

CHERRIES

Spray Schedule

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for Forbes scale	Before buds begin to open	Dormant oil, 3 gal.
Ground spray, for leaf spot	In early spring before buds begin to open Apply to ground only. Use 500 gal. per acre	"Elgetol," ½ gal.
1st cover, for brown rot, leaf spot, curculio, and slug	Right after shucks have fallen	Lead arsenate, 3 lb. — or — 50% dieldrin, ½ lb. — plus either — 70% ferbam, 1½ lb. — or — Glyodin, 1 qt. Hydrated lime, ½ lb.
2d cover, for same pests as 1st cover	10 days after 1st cover	Same as for 1st cover
Additional spray — for leaf spot.....	Right after harvest	Glyodin, 1 qt. — or — 75% ferbam, 1½ lb. — or — Actidione, 2 ppm

Thorough Spraying Is Essential for All Fruits

Use adequate pressure. Do not rely on measurements of pressure gages after two or more seasons of service — have the gages checked.

Select disks with correct openings and replace worn disks. Be sure the disks will carry the maximum load. A 35-gallon pump should discharge at least 30 gallons a minute during full operation.

Spray tops of trees with special care. Equip the spray rig with a tower. Apply top-off sprays when recommended.

Examine fruit and leaves frequently. Look for evidence of disease and insect injury. See whether spray coverage is complete, especially in tops of trees.

Apply enough spray. And remember that one good spray is worth more than two poor ones.

BRAMBLES

Sanitation

Certain diseases of brambles such as *crown gall, orange rust, mosaic, leaf curl,* and *bramble streak* cannot be controlled by spraying. The following practices are recommended to aid in preventing these diseases:

(**1**) Do not replant on a site where diseased plants have been recently grown. (**2**) Select resistant varieties. (**3**) Order planting stock from a reliable nursery. (**4**) Have plantings of red and black raspberries as much as 300 feet apart. (**5**) As soon as diseased plants are detected, dig them up with as many of their roots as possible, and burn at once. (**6**) At planting time cut off old stubs of 2-year-old nursery stock and "handles" of young purple and black raspberries. (**7**) Remove and burn old fruiting canes immediately after harvest.

For a full discussion of selection of varieties and cultural methods, see Illinois Circular 508, "Bramble Fruits."

Spray Schedule for Brambles

Application and purpose	Time to apply	Materials in 100 gallons of water
Delayed dormant, for anthracnose, spur blight, mites, and rose scale	In spring after growth has started but preferably before leaflets are ⅜ in. long	Dry lime sulfur, 20 lb. — or — Dormant oil, 3 gal. Copper sulfate, 8 lb. Hydrated lime, 8 lb.
Cover sprays, for anthracnose, spur blight	Every 7 to 10 days after delayed dormant until prebloom	75% ferbam, 1½ lb.
Prebloom, for anthracnose	Immediately before bloom	Same as for cover sprays
—If fruit worms or sawfly larvae are present	.....	Lead arsenate, 2 lb. added to above spray
Postbloom, for anthracnose	Immediately after bloom	Same as for cover sprays
Special sprays, for mites	June and early July	*See pages 14 to 16*
Post-harvest spray, for anthracnose and Septoria leaf spots and mites	Immediately after harvest	75% ferbam, 1½ lb. Summer oil, 1 gal.
—If mites are serious	.....	*See pages 14 to 16*

CURRANTS, GOOSEBERRIES, GRAPES

Spray Schedule for Currants and Gooseberries

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale insects	Before growth starts	Dormant oil, 2 gal.
1st cover, for currant aphids and leaf spot	When leaves start to unfold	Copper sulfate, 4 lb. Hydrated lime, 6 lb. Nicotine sulfate (40%), 1 pt.
2d cover, for currant worm and leaf spot	When in full foliage; do not wait for worms to appear	Copper sulfate, 4 lb. Hydrated lime, 6 lb. Lead arsenate, 2 lb.
Additional covers		
—for leaf spot.....	2 sprays 2 weeks apart, following 2d cover	Same as for 2d cover except omit lead arsenate
—for worms feeding on plants in fruit.....	As needed	Rotenone garden dust or spray (*comparatively non-poisonous to man*)

Spray Schedule for Grapes[a]

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale and anthracnose	Before buds open (*seldom needed*)	Commercial liquid lime sulfur, 7 gal.
1st cover, for black rot and grape flea beetle	When new growth is 2 to 4 inches long	DDT, 1 lb. actual[b] 75% ferbam, 1½ lb. Soybean flour, ¼ lb.
2d cover, for grape berry moth, rose chafer, black rot, and anthracnose	Just before the bloom	DDT, 1½ lb. actual[b] 75% ferbam, 1½ lb. Soybean flour, ¼ lb.
3d cover, for grape leafhopper, grape leaf folder, grape root worm, rose chafer, black rot, anthracnose, and downy mildew	After bloom, when berries are set	Same as for 2d cover[c]
4th cover, for leafhopper, black rot, anthracnose, ripe rot, mildews	3 weeks after 3d cover	Same as for 2d cover

[a] This schedule is based on the supposition that each application will use approximately 250 gallons of spray per acre.

[b] If grape mealybug is serious substitute 2 pounds of 15-percent parathion for the DDT. (Before using parathion, see pages 9 to 12 for precautions.)

[c] If powdery-mildew infection develops, substitute one of the insoluble copper sprays for the ferbam.

STRAWBERRIES

Sanitation

Diseases and insects of strawberries can usually be controlled by cultural and sanitary methods. The following practices are recommended:

(**1**) To avoid white grubs, do not plant strawberries on sodland until it has been under cultivation for at least two years. (**2**) To reduce crown borer injury, separate new beds at least 350 yards from old beds and plow up the patch after two picking seasons. (**3**) Choose varieties resistant to disease in so far as possible. For example, in areas where red stele root rot is common, plant varieties resistant to this disease. (**4**) Renovate beds immediately after each harvest.

For a full discussion of cultural and sanitation methods for strawberries, see Illinois Circular 453, "Strawberry Culture in Illinois" (revised in 1955).

Spray Schedule for Strawberries

Application and purpose	Time to apply	Materials in 100 gallons of water[a]
1st cover, for leaf spot, leaf roller, gray mold, weevil, and buttoning pests	First appearance of blossoms	50% captan, 2 lb., plus either malathion, 4 lb., or chlordane, ½ lb. actual and 50% DDT, 1 lb.
2d cover, for same pests as 1st cover	10 days after 1st cover	50% captan, 2 lb.
3d cover, for gray mold	10 days after 2d cover	Same as for 2d cover

[a] With the dosages given in the table, apply 300 gallons per acre. The dosages can be increased as much as 4 times, thus using only 75 gallons of spray per acre. For best results, however, use at least 100 gallons per acre. It's important to apply at least 5 pounds of 50-percent captan per acre with each application.

A dust containing 5-percent DDT and 7.5-percent captan, plus either 5-percent malathion or 5-percent chlordane, is recommended for control of strawberry insects and diseases. Apply 30 pounds per acre when blooms first appear and again in 10 days. A third dust containing only captan would help to control gray mold. Dusts are more effective than highly concentrated (4x and over) sprays.

The malathion program is suggested where leaf roller is a problem.

(Orchardists will find this kind of spray record very useful.)

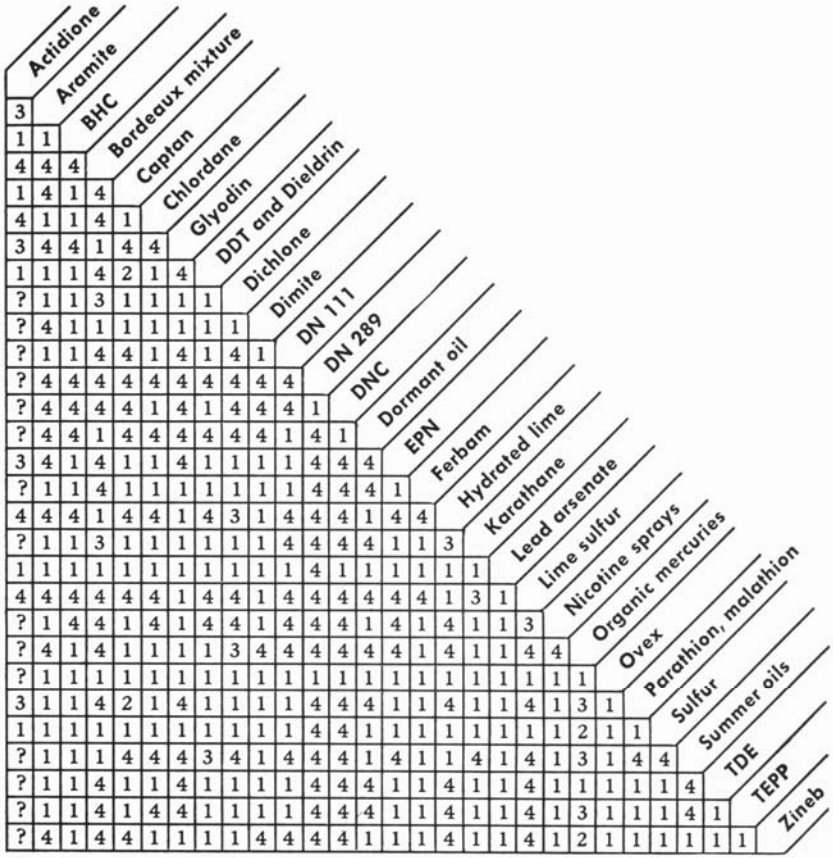
RECORD OF MY APPLE SPRAY SCHEDULE 195__

SPRAY	Started (date)	Finished (date)	Total gals. or tanks	Materials used or other remarks
Dormant				
Prepink				
Pink				
Bloom				
Calyx				
Calyx top-off				
COVER				
First				
Second				
Third				
Fourth				
Fifth				
Sixth				
Sixth top-off				
SECOND BROOD				
First				
Second				
Third				
Fourth				

RECORD OF MY PEACH SPRAY OR DUST SCHEDULE 195__

SPRAY or DUST	Started (date)	Finished (date)	Wind direc-tion	Amount of material used	Materials used or other remarks
Dormant					
Prebloom					
Bloom					
Shuck-split					
COVER					
First					
Second					
Third					
Fourth					
Fifth					
Sixth					
Seventh					
Eighth					
Ninth					
Tenth					
Eleventh					

COMPATIBILITY CHART FOR ORCHARD INSECTICIDES AND FUNGICIDES



Key to symbols

1 — Materials can be used together.
2 — Materials can be used together except for certain formulations.
3 — Caution is needed in using these materials together.
4 — Materials cannot be used together.
? — Compatibility has not been determined.

How to use this chart

This chart is made on the same principle as a mileage chart. For instance, if you want to know whether Bordeaux mixture and DN 111 should be used together, you read down the column headed by "Bordeaux mixture" until you get to the row labeled "DN 111." The "4" where the two meet indicates that the materials are not compatible and should not be used together.

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